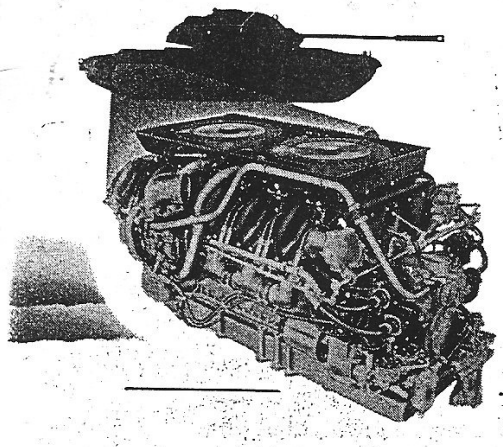

BULLETIN NO. 20[illegible]
Rev. [illegible]

Continental Motors Corporation
MILITARY DIVISION
Muskegon, Michigan

FIELD SERVICE BULLETIN

February 1, 1956

DIFFERENCES BETWEEN MODEL AV-1790-7, AVI-1790-8 AND AVSI-1790-6 ENGINES

Following are the major differences between the subject engines. Other than for these, the engines are basically the same. All incorporate the replaceable 12-cylinder "V" arrangement, air cooling, and the other features of the standard AV-1790 model. Many parts are interchangeable between the three models.

The information and figures given are not to be construed as official insofar as the AVI-1790-8 and AVSI-1790-6 models are concerned. They are published for the convenience of all concerned pending the issuance of official publications covering these two models.

FUEL SYSTEMS

The AVI-1790-8 and the AVSI-1790-6 have each bank of six cylinders served by a fuel injector pump instead of the carburetor used on the AV-1790-7. Liquid fuel is pumped from each injector to the individual cylinders on that side through individual external metallic tubes. The injector pumps are calibrated and timed so that the proper amount of fuel for the engine operating conditions arrives at each cylinder at the proper time. An injector spray nozzle located in the intake manifold tube for each cylinder atomizes the fuel and discharges it through the open intake valve port into the combustion chamber. See Field Service Bulletin No. 193 for detailed information on the fuel injection system.

Two diaphragm type fuel pumps supply gasoline to the carburetors on the AV-1790-7 model. They are interconnected so that, in the event of the failure of one pump, both carburetors will still be supplied. The main fuel tanks on vehicles employing either of the injected engines are equipped with tank pumps. These force the fuel to the single Titan vane-type pump which raises the pressure to a minimum of 15 psi. After passing through the fuel filter, the gasoline is transmitted to the two injector pumps. The injectors increase the fuel pressure to the 50 to 70

psi required to open the pintle valve in the injector nozzles. To dispose of the fuel vapor which tends to form at higher fuel temperatures, a spill vent which bleeds back into the main tank is provided in each injector. The pressure induced at the injectors by the vane-type pump is utilized for this venting. The bleed rate is constant at about twelve gallons per hour per injector.

One of the two injectors is mounted on each side of the accessory drive housing on the AVI-1790-8 and AVSI-1790-6 models. This drive housing is a one-piece aluminum casting mounted on the machined top of the accessory case on the injected models. It provides mounting for an acceleration booster pump on each side and the governor on top, in addition to the injector pumps. The pumps, governor and cooling fans are driven by gears within the drive housing which, in turn, are driven by the gear train within the accessory case. Drilled oil passages in the housing, which register with passages in the accessory case, provide oil for the injector pump servo system. Internal passages also provide an oil connection between the injector pumps and the acceleration booster pumps.

INDUCTION SYSTEMS

Like the AV-1790-7, the AVI-1790-8 is naturally aspirated. However, while the AV model carries a carbureted mixture of gasoline vapor and air through the intake system to the cylinders, the AVI intake system carries only air. Gasoline is introduced into the air only at the cylinder, as noted above.

The AV-1790-7 uses a straight, runner type manifold for each bank of six cylinders. The outlet for each cylinder is cast integrally with a section of the main tube. The main tube sections are joined by rubber hoses and hose clamps. On the AVI-1790-8, the air is inducted through a throttle body mounted directly on the center section of the intake manifold between the No. 3 and No. 4 cylinder on each side. These throttle bodies have the necessary taps for breathing the engine as well as outlets for controlling fuel metering in the injectors. Outlets in the bodies also provide a source of vacuum for venting the engine accessories. The center manifold section has six outlets (three toward the front of the engine and three toward the rear) which connect to individual tubes running to each cylinder.

The use of a supercharger for each bank of cylinders on the AVSI-1790-6 is the major difference between the induction system on this engine and those on the two engines mentioned above. A supercharger is mounted on the oil pan and crankcase on each side of the AVSI-1790-6 model and is driven through a gear train mounted in the oil pan. Power is taken from the main accessory drive gear by an idler gear in the accessory case which, in turn, drives a second idler mounted in the oil pan. A long quill in the pan transmits power to a set of bevel gears mounted half-way down the pan. These drive the superchargers through two short quills.

Air is taken into each supercharger through a throttle body mounted on the supercharger inlet. These bodies, like those on the AVI-1790-8, provide taps for breathing the engine, controlling fuel metering in the injectors, and giving a vacuum source for venting the engine accessories. Each supercharger scroll has two outlets, each of which passes air into a divider from which three steel tubes carry the air to three individual cylinders.

The impeller and shaftgear assembly in each supercharger are balanced as a unit and must be used as a unit. If disassembled, they must be reassembled in the same relationship to each other as indicated by the locating marks on the impeller and shaft.

The tendency of liquid gasoline to precipitate out of the carbureted mixture in the intake manifold during cold starts requires a hotspotting system on the AV-1790-7 model. This system, by heating the carbureted mixture, tends to keep the gasoline in vapor form in the intake air and prevents the leaning out of the mixture due to precipitation during cold starts.

The AVI-1790-8 and the AVSI-1790-6 models, however, need no hotspotting, since the liquid gasoline is atomized at the cylinder intake ports by the spray nozzles.

BREATHING SYSTEMS

On the AV-1790-7, the velocity of the air entering the left carburetor is used to circulate air through the crankcase and accessory case. Fresh air is drawn into the engine through a tube originating at the carburetor air inlet elbow on the right side and leading to the oil filler tube. Another tube connects the oil filler tube to the crankcase, and a third runs from the top of the accessory case to the top of the left carburetor. Thus, ventilating air is circulated from the fresh air inlet on the right carburetor, through the crankcase and accessory case, out of the accessory case, and into the intake manifold through the left carburetor. Cylinder blow-by gases are thus picked up in the crankcase and carried back to the intake system.

The AVI-1790-8 and the AVSI-1790-6 breathing systems operate differently from that on the AV-1790-7. The injected engines provide an escape for blow-by gases and excessive crankcase pressures at each end of the engine. A single horizontal tube on the right of the engine connects the oil filler pipe at the rear with two oil separators opening into the accessory case. Midway in this tube, at a point above the right supercharger air inlet, is an escape valve. The valve is the needle type with atmospheric pressure on a diaphragm tending to keep it closed. When crankcase pressure exceeds atmospheric pressure, the valve opens and allows the blow-by gases to escape through a tube into the right supercharger air inlet. When atmospheric pressure overcomes the internal pressure, the valve closes. The tube

to the supercharger inlet contains a flame arrestor. The oil separators on the accessory case collect oil carried out of the case during the escape of gases. The oil is carried to the oil pan by a small diameter tube assembly.

The use of this system maintains a slight crankcase pressure at all times, and gases tend to flow out of the crankcase but outside air cannot flow into it through the breathing system. This arrangement forestalls the entrance of dirt-laden air into the engine should the oil filler cap be left off or lost, or should any other abnormal opening occur in the breathing system.

OIL PANS, OIL PUMPS, AND LUBRICATION SYSTEMS

The same oil pan is used on the AV-1790-7 and the AVI-1790-8, and the oil pumps are similar. The pan is a one-piece aluminum casting which is divided into two compartments by a transverse baffle. The smaller compartment, located at the accessory end of the pan, forms a reservoir for the pressure oil pump. This compartment is so ducted as to allow oil to flow into it from the larger flywheel end compartment when the flywheel end of the engine is the higher and prevent the oil from flowing out when the accessory end is the higher.

Both the above engines are lubricated by a forced-feed system. Pressurized oil is supplied the engine by a combination scavenge and pressure pump mounted on the underside of the accessory case. The scavenge impellers are located above the pressure impellers in the single pump housing. The scavenge pump of this dual unit transfers oil from the large flywheel end compartment of the pan to the accessory end compartment which supplies oil to the pressure pump. Normally, oil passes from the pressure pump through an accessory case passage and an oil filter housing passage and into an external line to the engine oil cooler. Another external line then conducts it to the engine oil filter and engine. Three valves control the flow of oil in the AV-1790-7 engine:

1. Oil Pressure Control Valve. Located at the engine oil passage inlet at the lower right side of the accessory case, this spring balanced valve maintains proper pressure in the engine oil passages. Excess oil is by-passed to the accessory case sump.

2. Oil Filter By-pass Valve. This spring balanced valve is located just in front of the oil pressure control valve. If the oil filter becomes plugged, the valve opens at a differential pressure of 50 psi, allowing the oil to by-pass the filter and go directly to the engine.

3. Oil Cooler By-pass Valve. This thermostatically controlled valve, located in the accessory case, allows part of the oil to by-pass the cooler when oil temperature is below 148°F. (formerly 185°F.). When these

temperatures are reached, the valves close and force all the oil to go through the coolers. Should the coolers become plugged, the valves open at a pressure differential of 60 psi to by-pass the oil around the coolers.

The AVSI-1790-6 pan is divided into three compartments by two transverse partitions. The large center compartment is an oil reservoir connected to both end compartments by long, cored channels. The channels are so laid out that oil can flow freely between compartments when the pan is horizontal, but cannot completely drain from any section under a tilted condition. The center reservoir and part of the accessory end section have an oil-tight cover. This catches throw-off oil and carries it to one of the end compartments. This pan arrangement, in conjunction with the 3-deck oil pump (see below), assures an adequate supply of oil for the pressure pump at all times and prevents flooding of either end of the engine up and through a 60% slope.

As mentioned above on the induction systems, the AVSI-1790-6 has integrally cast pads in the oil pan which provide mountings for the gear train driving the supercharger impellers. Drilled oil passages in the pan, which connect with those in the accessory case, provide lubrication for the supercharger drive gear train.

The AVSI model is also lubricated by a forced feed system. The combination oil pump contains, in one housing, scavenge impellers on top, pressure impellers in the center, and a set of oil level control impellers on the bottom. The scavenge pump transfers oil from the flywheel end compartment of the pan to the accessory end section where it is picked up by the pressure pump. Flooding of the accessory end section is prevented by the oil level control pump transferring excess oil to the middle (reserve oil) compartment.

In normal operation the oil from the pressure pump is transmitted through drilled passages in the accessory case to an external housing which contains a maximum oil pressure valve and an oil cooler by-pass valve. From here, the oil goes to the engine cooler and then to the accessory case. It then passes to the filter and into the main crankcase oil gallery. The flow of oil is controlled by the following valves in the AVSI-1790-6 and AVI-1790-8 engines:

1. Maximum Oil Pressure Valve. This spring loaded valve is in the maximum oil pressure valve housing located at the lower front of the accessory case. It passes oil back into the pan when low temperature starting results in oil pressures of 250 psi or more. This prevents the cold oil from rupturing the engine oil cooler due to excessive pressure.

2. Mechanical Oil Cooler By-pass Valve. Also located in the maximum oil pressure valve housing, this spring loaded valve insures lubrication of the engine in the event the engine oil cooler becomes plugged. It

causes the oil to by-pass the cooler when the pressure drop across the oil cooler reaches 80 psi.

3. Thermostatic Oil Cooler By-pass Valve. This valve is located at the left rear corner of the wrap-around oil cooler. It remains open and allows the oil to by-pass the cooler until it reaches 148°F. At this temperature, the valve closes and forces the oil into the cooler.

4. Oil Filter By-pass Valve. This is the smaller of the two valves located immediately below the oil filter housing on the right side of the accessory case. It forces oil to by-pass the filter if a pressure differential of 50 psi or more is built up in the filter as a result of plugging.

5. Main Oil Pressure Regulating Valve. This valve is larger than the oil filter by-pass valve and is installed immediately behind it. It maintains the pressure in the main crankcase oil gallery at 70 to 80 psi by by-passing excess oil into the pan.

6. Minimum Oil Pressure Valve. This valve maintains oil pressure to the injectors at a minimum of 40 psi at engine cranking speeds. The purpose of this is to provide sufficient oil pressure to return the injector "Z" shaft to the closed position. The valve accomplishes this by blocking the main oil gallery until a pressure of 40 psi is obtained. The period during which oil flow is restricted occurs only during the cranking period, at which time the residual oil on the moving parts of the engine protects them.

OIL COOLING SYSTEMS

The AV-1790-7 engine has its oil cooler mounted separately from the engine on an outrigger bracket attached to the right of the power plant (left of engine). Of the three cooler cores on this side, two serve the engine with the third reserved for transmission cooling. The similarly mounted three-core cooler on the left of the power plant serves the transmission. A mechanically driven fan draws cooling air through each of the coolers.

The AVI-1790-8 and AVSI-1790-6 have oil coolers integral with the engine. The rectangular cooling unit is mounted around the top of the engine in such a manner that the two engine fans draw cool air through it. The cooler is divided in such a way that the deep core section at the flywheel end and the two core sections on the right (as viewed from the accessory case end of the engine) cool the transmission oil. The accessory end and two left cores cool the engine oil.

FLYWHEELS

The AVSI-1790-6 engine, unlike the AVI-1790-8 and AV-1790-7, has an internal ring gear flywheel and is not equipped with a torsion spring damper. The AV-1790-7 and AVI-1790-8 flywheels are similar except the AVI-1790-8 flywheel uses an accessory drive adaptor without a torsion spring damper, and the AV-1790-7 uses a torsion spring damper and does not have an accessory drive adaptor. In addition to the valve and ignition timing marks on the AV-1790-7 flywheel, those on the injected models have marks for timing the fuel injectors.

PISTONS

The AV-1790-7 and AVI-1790-8 engines have a compression ratio of 6.5:1. Both have cast aluminum pistons. The AVSI-1790-6 engine has forged aluminum pistons with a 5.5:1 ratio.

C. W. Riddell
Divisional Director
Field Service Department

Reason for revision No. 1:

1. Revise AVI-1790-8 Horsepower and Torque information.
2. Revise valve event clearance information on AVI-1790-8 and AVSI-1790-6 engines.
3. Add overlap of valve events.

Reason for revision No. 2:

1. Revise information on oil flow of AVI-1790-8 engine.
2. Revise information on AVI-1790-8 engine pistons and flywheel.
3. Revise information on AVI-1790-8 and AVSI-1790-6 maximum torque.
4. Revise information on spark plug gap setting, all engines.
5. Revise model designation of American Bosch magneto for AVI-1790-8 engine.
6. Revise fuel pump model No. AVSI-1790-6 and AVI-1790-8 engines.

DATA AND OPERATING LIMITS

	AV-1790-7	AVI-1790-8	AVSI-1790-6
Horsepower at 2800 rpm (60 deg. F. and 29.92 in. Hg abs.)	810 BHP	810 BHP	1000 BHP
Maximum Torque (60 deg. F. and 29.92 in. Hg abs.)	1580 lbs-ft	1635 lbs-ft.	1935 lbs-ft.
Speed of Maximum Torque	2400 rpm	2250 rpm	2400 rpm
Engine Governed Speed, Full Load	2800-2830 rpm	Same	Same
Maximum Governed Speed, No Load	2980 rpm	Same	Same
Engine Warm-Up Speed	1000-1100 rpm	Same	Same
Engine Idling Speed	650 rpm	Same	Same
Dry Weight With Accessories	2647 lbs.	2975 lbs.	3050 lbs.
Height	40.84 in.	42.77 in.	45.68 in.
Width	59.83 in.	48.50 in.	56.74 in.
Length	73.70 in.	72.56 in.	72.83 in.
Cylinder Bore	5.75 in.	Same	Same
Piston Stroke	5.75 in.	Same	Same
Compression Ratio	6.5 : 1	6.5:1	5.5 : 1
Firing Order	1R, 2L, 5R, 4L, 3R, 1L, 6R, 5L, 2R, 3L, 4R, 6L;	Same	Same
Induction System	Naturally Aspirated	Naturally Aspirated	Supercharged
Ignition System	High Tension Magnetos	Same	Same

DATA AND OPERATING LIMITS, (Cont'd.)

	AV-1790-7	AVI-1790-8	AVSI-1790-6
Fuel Delivery	Two Carburetors	Two Fuel Injectors	Two Fuel Injectors
Ignition Timing (Static)	10 deg. BTC	Same	Same
Valve Timing Setting, .100 in. Clearance	50 deg. ABC	Same	Same
Valve Events	Cold Clearance	Cold Clearance	Cold Clearance
Intake Opens	40 deg. BTC	32 deg. BTC	Same
Intake Closes	84 deg. ABC	85 deg. ABC	Same
Exhaust Opens	68 deg. BBC	56 deg. BBC	Same
Exhaust Closes	32 deg. ATC	24 deg. ATC	Same
Valve Clearances	Cold	Same	Same
Intake	.007 in.		
Exhaust	.020 in. (.014 in. under roller)		
Overlap Of Valve Events (At .015 in. clearance both valves, inspection purposes only)	60 deg.	50 deg.	Same
Spark Plug Gap	.017 - .020 in.	Same	Same
Maximum Spark Plug Gasket Temperature (125 deg. cooling air)	525 deg.	Same	Same
Crankshaft Rotation Viewed From Accessory End	Clockwise	Same	Same
Camshaft Rotation Viewed From Accessory End	Counter-Clockwise	Same	Same
Fuel Specification	MIL-G-3056A 86 Octane	Same	Same
Oil Specification (All Three Engines)	MIL-O-2104 Seasonal Grade As Follows: +30 deg. to +125 deg. Ambient Temp. -- SAE 50 -30 deg. to +40 deg. Ambient Temp. -- SAE 10 0 deg. to -70 deg. Ambient Temp. -- Arctic		

ACCESSORIES

	AV-1790-7			AVI-1790-8			AVSI-1790-6		
ACCESSORY	Make	Model	Dr. Ratio to Crankshaft Speed	Make	Model	Dr. Ratio to Crankshaft Speed	Make	Model	Dr. Ratio to Crankshaft Speed
Generator	-7 Eclipse-Pioneer	30E003A	2.56 : 1						
	-7B & -7C Jack & Heintz	G22	2.56 : 1	Same	Same	Same	Same	Same	Same
Starter	Jack & Heintz	JRD 30	1.15 : 1	Same	Same	Same	Same	Same	Same
	Or Eclipse-Pioneer	1416-29-F	1.15 : 1	Same	Same	Same	Same	Same	Same
Spark Plugs	BG	RB 897-S		Same	Same		Same	Same	
	Champion	TAC-2		Same	Same		Same	Same	
	AC	WR-42-L		Same	Same		Same	Same	
	Auto Lite	AER-2S		Same	Same		Same	Same	
Governor	Novi		1.29 : 1	Novi		1.11 : 1	Novi		1.11 : 1
Fuel Pump	AC	BF	.58 : 1	Titan	H2E3-15	.86 : 1	Titan	H2E3-15	.86 : 1
Booster Coil	Bendix-Scintilla			Same			Same		
Magneto	Bendix-Scintilla	S6LN-32	.50 : 1	Same	Same	Same	Same	Same	Same
				Or Am. Bosch	MRE-6A41	.50 : 1	Or Am. Bosch	MRE-6A43	.50 : 1

ACCESSORIES, (Cont'd.)

	AV-1790-7			AVI-1790-8			AVSI-1790-6		
ACCESSORY	Make	Model	Dr. Ratio to Crankshaft Speed	Make	Model	Dr. Ratio to Crankshaft Speed	Make	Model	Dr. Ratio to Crankshaft Speed
Fuel Filter Element	AC	Disc Type		Purolator	PR-150-2		Purolator	PR-150-2	
Primer Filter	-7 & -7B Zenith -7C Skinner	EF 450-0		Same	Same		Same	Same	
Fuel Injector				Simmonds	SU-15G	1.00 : 1	Simmonds	SU-15C	1.00 : 1
Carburetor	Stromberg-Eclipse	NAY-5G3							
Cooling Fan			1.79 : 1			1.85 : 1			2.00 : 1
Supercharger									7.86 : 1
Oil Pump			Thru Serial #21988 1.20 : 1 Serial # 21989 & Up 1.72 : 1			Same			Same
Power Take-Off			1.00 : 1			1.00 : 1			1.00 : 1
Camshafts			.50 : 1			.50 : 1			.50 : 1